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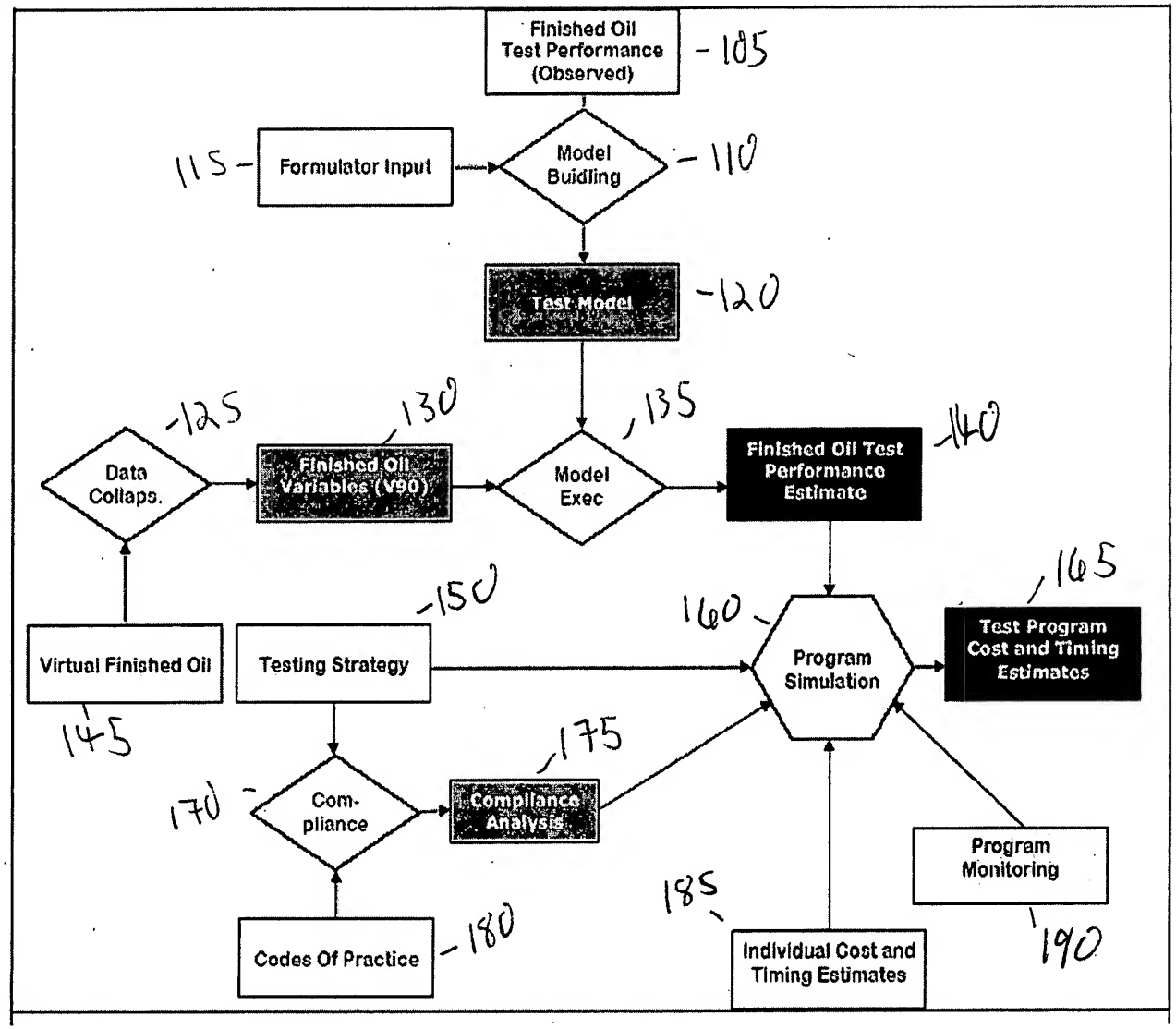

Finished Oil Test Performance (Observed)
105
115
Formulator Input
Model Buidling
110
Test Model
120
125
Data Collaps.
130
Finished Oil Variables (V90)
135
Model Exec
Finished Oil Test Performance Estimate
140
165
Test Program Cost and Timing Estimates
160
Program Simulation
150
Testing Strategy
Virtual Finished Oil
145
175
170
Com-pliance
Compliance Analysis
Program Monitoring
190
185
Individual Cost and Timing Estimates
Codes Of Practice
180

Fig. 1

TU3MS TEST

Test Run On

Can be read across (RA) to:

	0W-20	0W-30	0W-40	5W-20	5W-30	5W-40	5W-50	10W-30	10W-40	10W-50	10W-60	15W-40	15W-50	20W-40	20W-50
0W-20	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
0W-30		-	RA		RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
0W-40			-			RA	RA		RA	RA	RA	RA	RA	RA	RA
5W-20		RA	RA	-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-30			RA		-	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
5W-40						-	RA		RA	RA	RA	RA	RA	RA	RA
5W-50							-			RA	RA		RA		RA
10W-30			RA			RA	RA	-	RA	RA	RA	RA	RA	RA	RA
10W-40							RA		-	RA	RA	RA	RA	RA	RA
10W-50										-	RA		RA		RA
10W-60											-				
15W-40							RA			RA	RA	-	RA	RA	RA
15W-50											RA		-		RA
20W-40							RA			RA	RA		RA	-	RA
20W-50											RA				-

Stipulated Requirement

The KV@100°C of the finished oil of the readacross grade must be greater than or equal to that of the tested grade.

Fig. 2

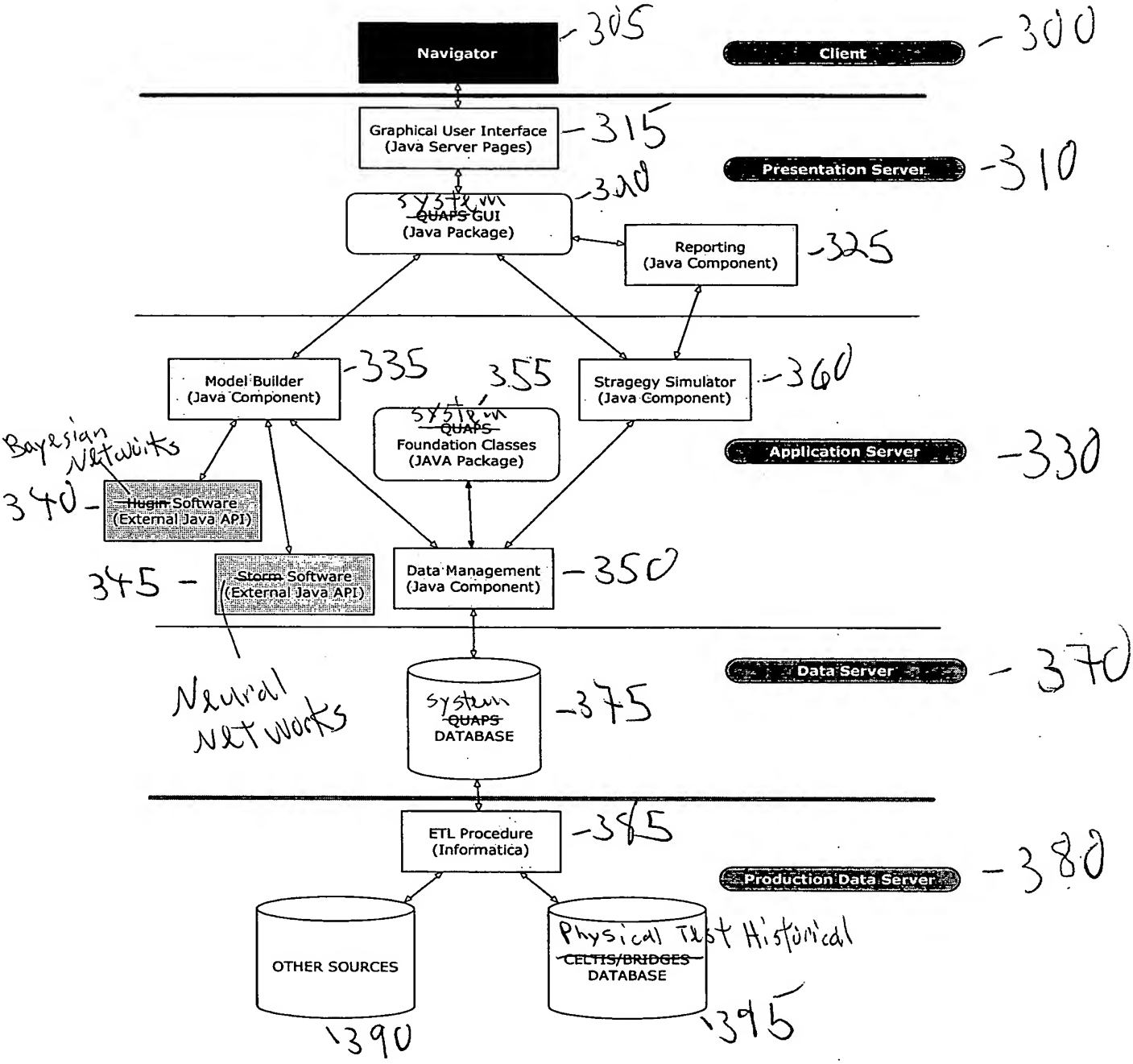

Navigator
305
Client
300
Graphical User Interface
(Java Server Pages)
315
Presentation Server
310
~~QUAPS~~ GUI
(Java Package)
320
Reporting
(Java Component)
325
Model Builder
(Java Component)
335
355
Stragegy Simulator
(Java Component)
360
~~QUAPS~~
Foundation Classes
(JAVA Package)
Application Server
330
Bayesian Networks
340
~~Hugin~~ Software
(External Java API)
345
~~Storm~~ Software
(External Java API)
Data Management
(Java Component)
350
Neural Networks
Data Server
370
~~QUAPS~~
DATABASE
375
ETL Procedure
(Informatica)
385
Production Data Server
380
OTHER SOURCES
390
~~CELTIS/BRIDGES~~
DATABASE
395
Physical Test Historical

Fig. 3

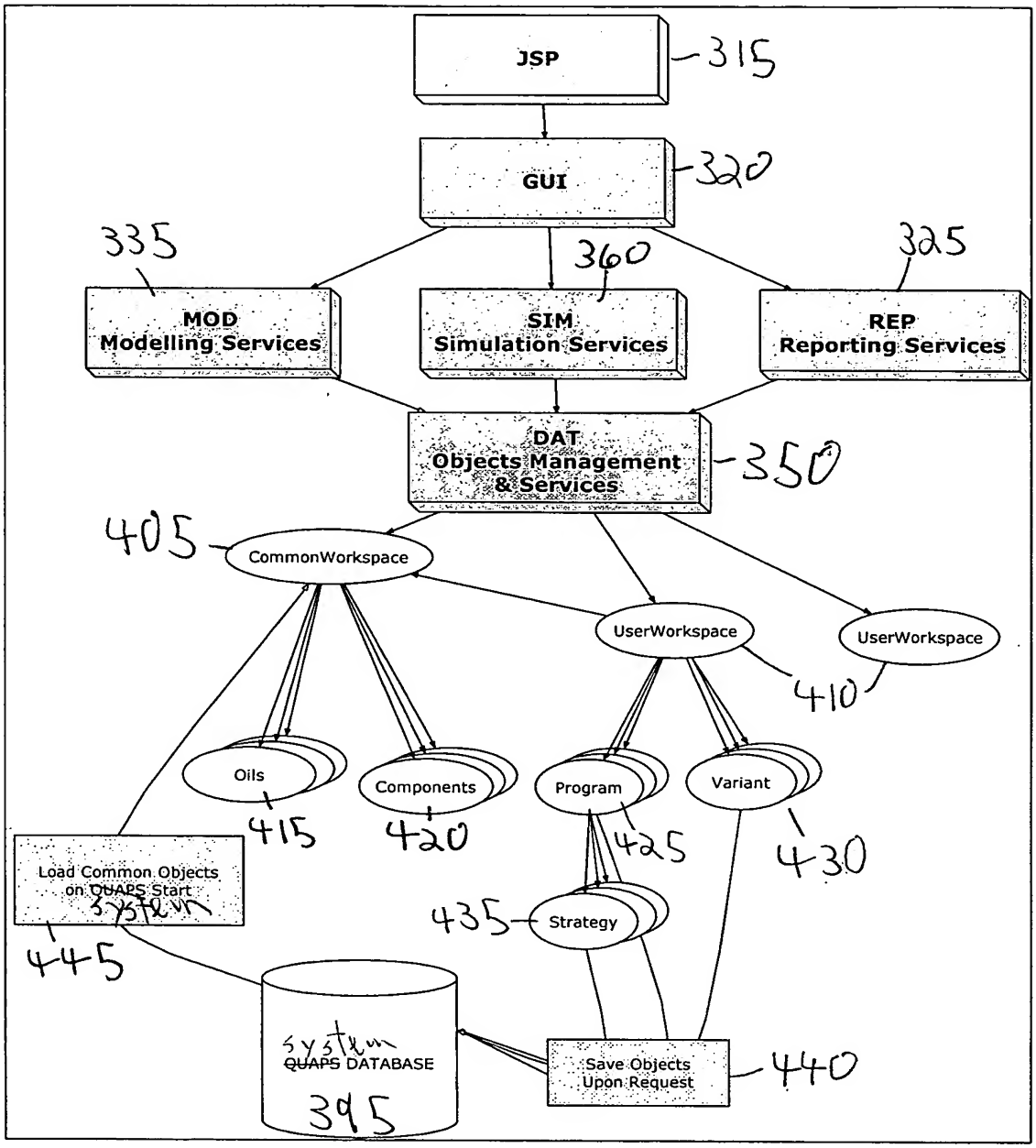

JSP
315
GUI
320
335
360
325
MOD
Modelling Services
SIM
Simulation Services
REP
Reporting Services
DAT
Objects Management
& Services
350
405
CommonWorkspace
UserWorkspace
UserWorkspace
410
Oils
415
Components
420
Program
425
Variant
430
Load Common Objects
on QUAPS Start
445
435
Strategy
QUAPS DATABASE
395
Save Objects
Upon Request
440

Fig. 4

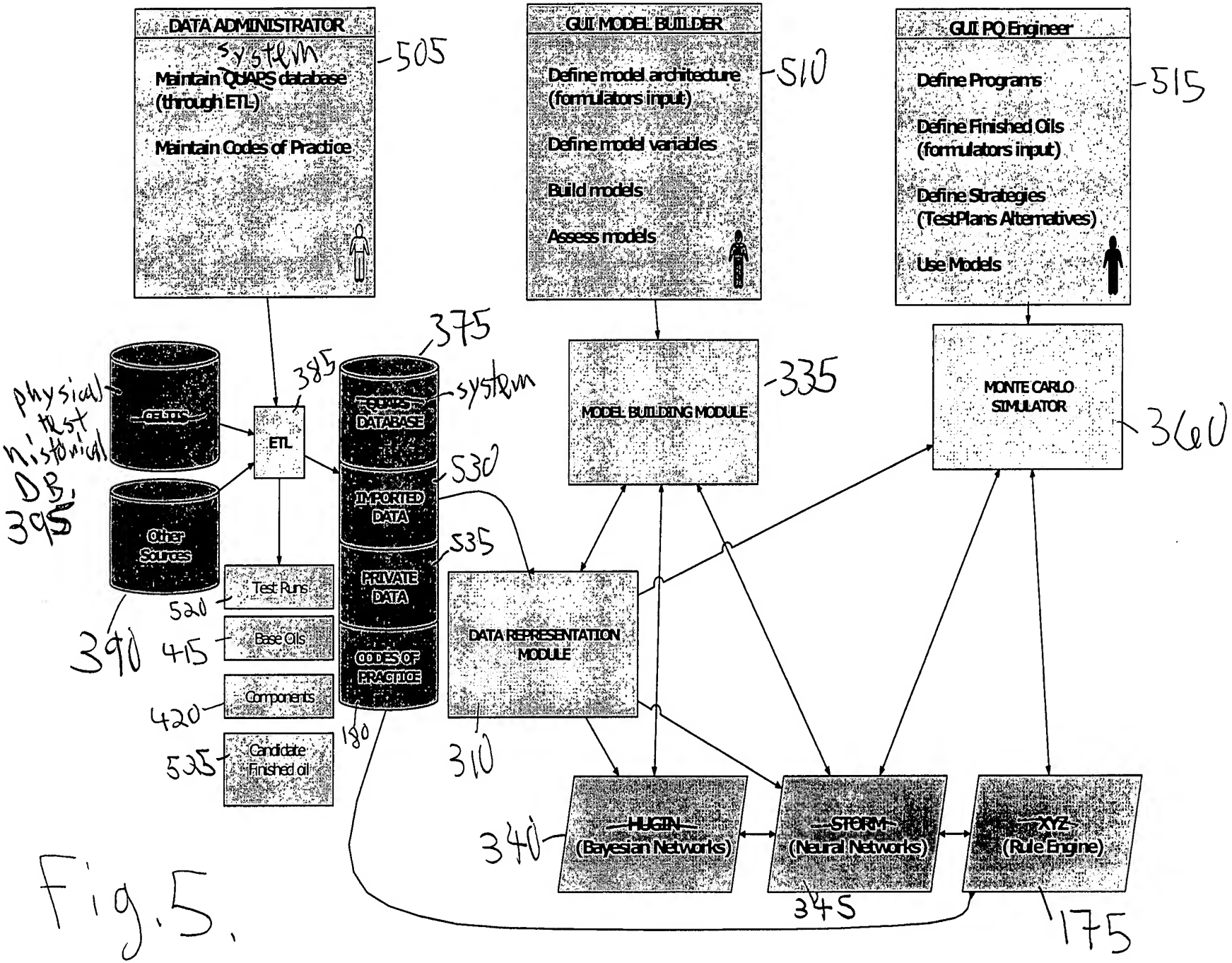

DATA ADMINISTRATOR
Maintain QUAPS database (through ETL)
Maintain Codes of Practice
505
GUI MODEL BUILDER
Define model architecture (formulators input)
Define model variables
Build models
Assess models
510
GUI PQ Engineer
Define Programs
Define Finished Oils (formulators input)
Define Strategies (TestPlans Alternatives)
Use Models
515
375
385
ETL
QUAPS DATABASE
IMPORTED DATA
PRIVATE DATA
CODES OF PRACTICE
530
535
180
Test Runs
Base Oils
Components
Candidate Finished oil
520
415
420
525
MODEL BUILDING MODULE
335
MONTE CARLO SIMULATOR
360
DATA REPRESENTATION MODULE
310
HUGIN (Bayesian Networks)
STORM (Neural Networks)
XYZ (Rule Engine)
340
345
175

Fig. 5.

System ~~QUAPS~~ Functional Architecture

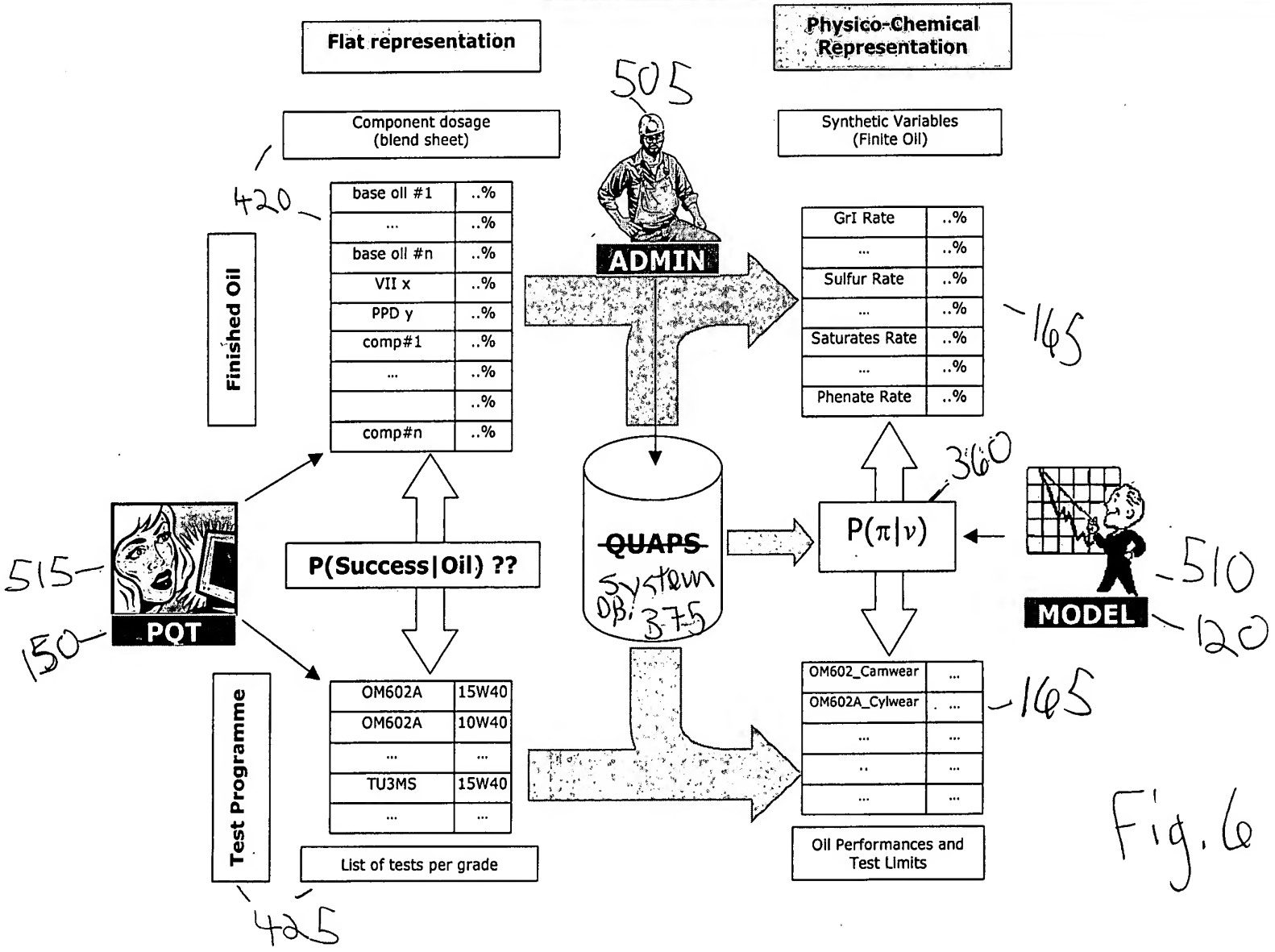
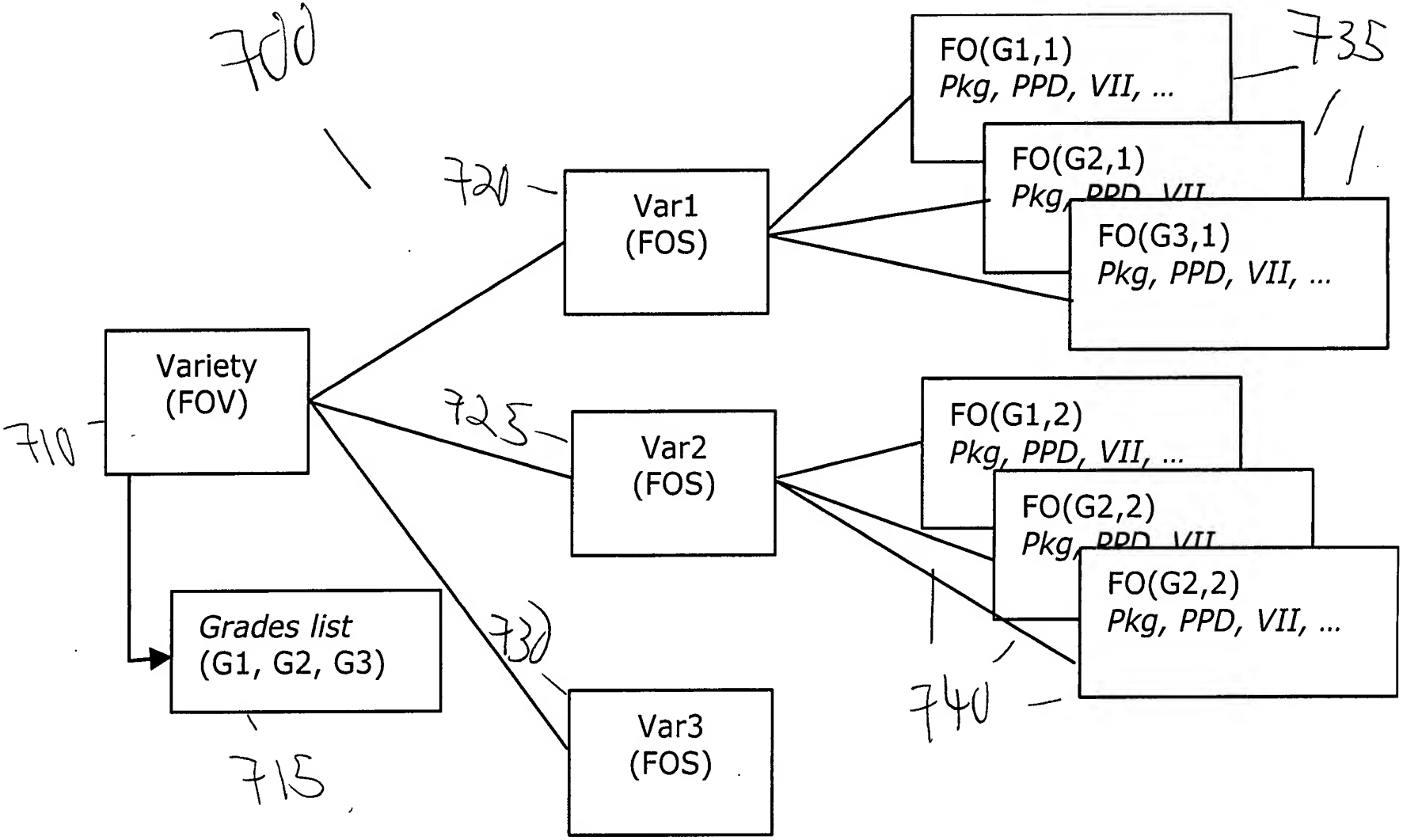
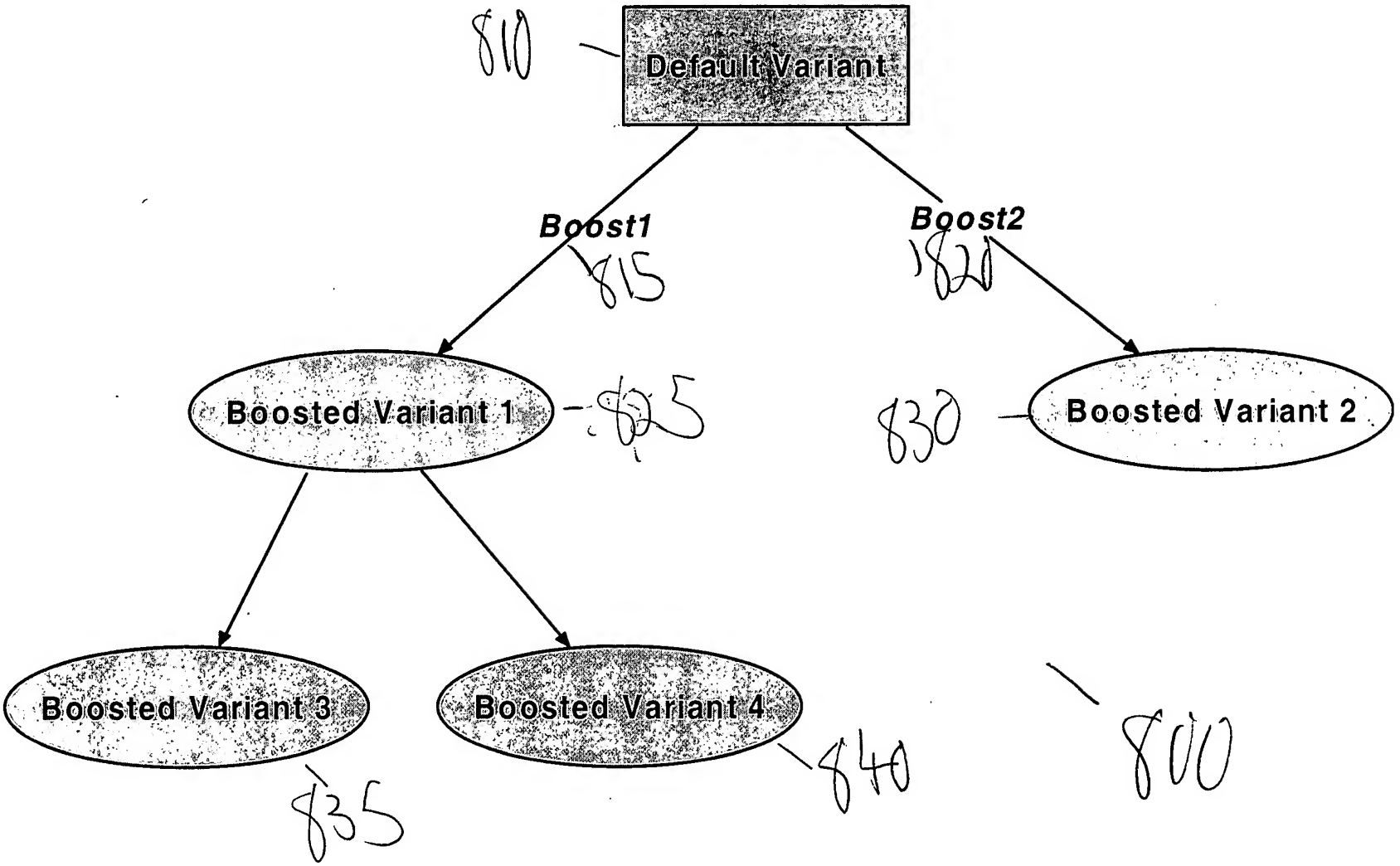


Fig. 6



Variant (FOS) Representation

FIGURE 7



Tree Organization of Variants

FIGURE 8

General Strategy Execution

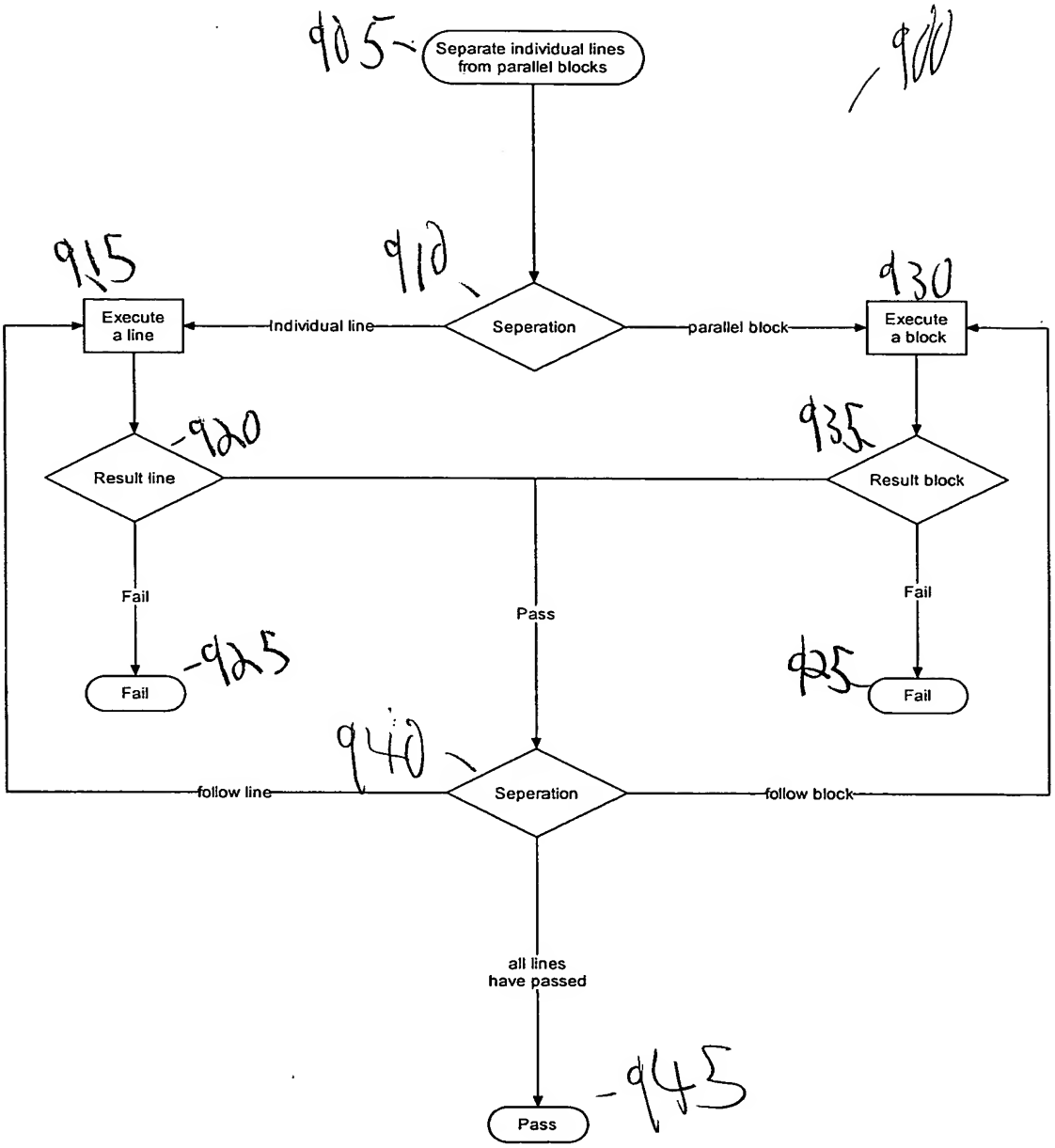


Fig. 9

Individual line processing

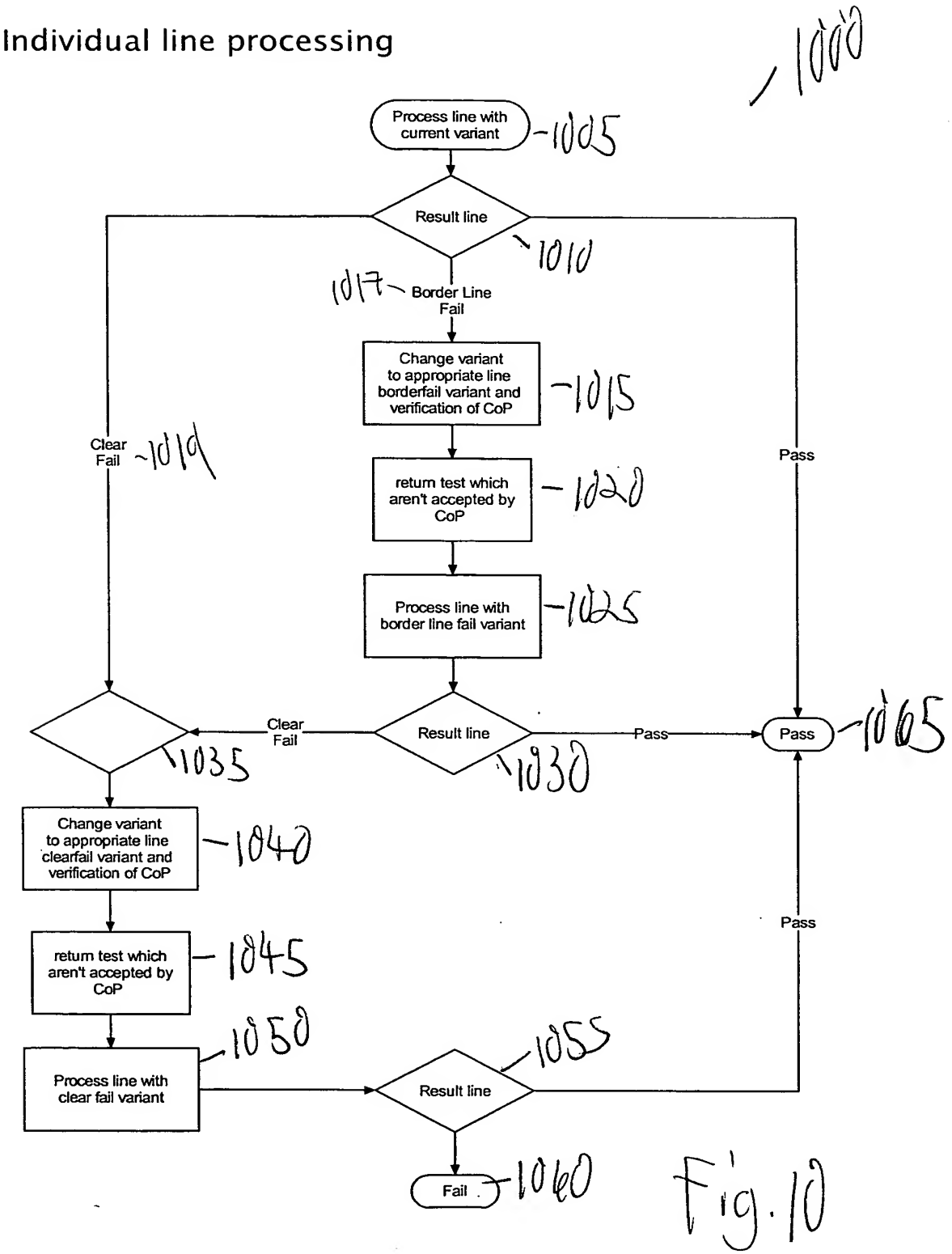


Fig. 10

Processing an individual line with a given variant

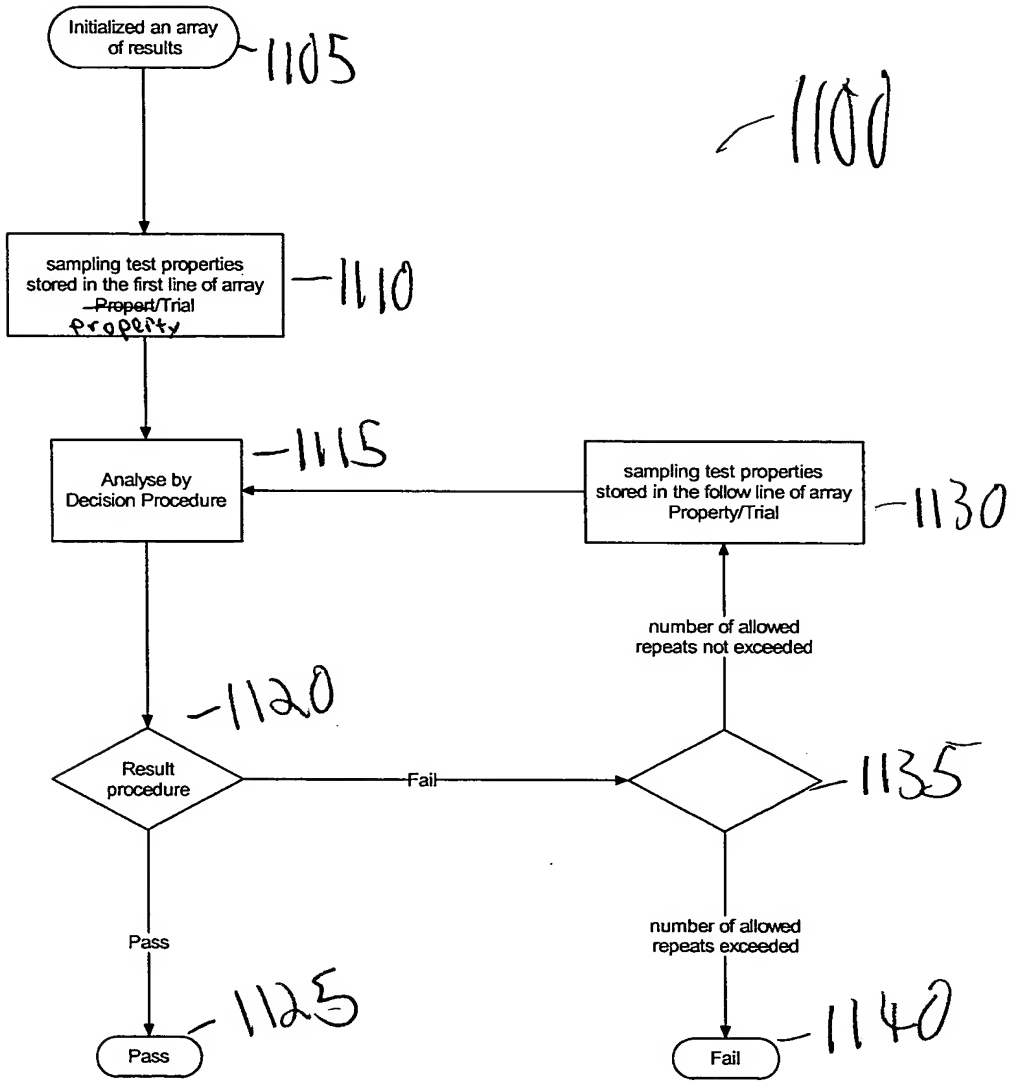


Fig. 11

Array of Result Decision Procedure (no MTAC)

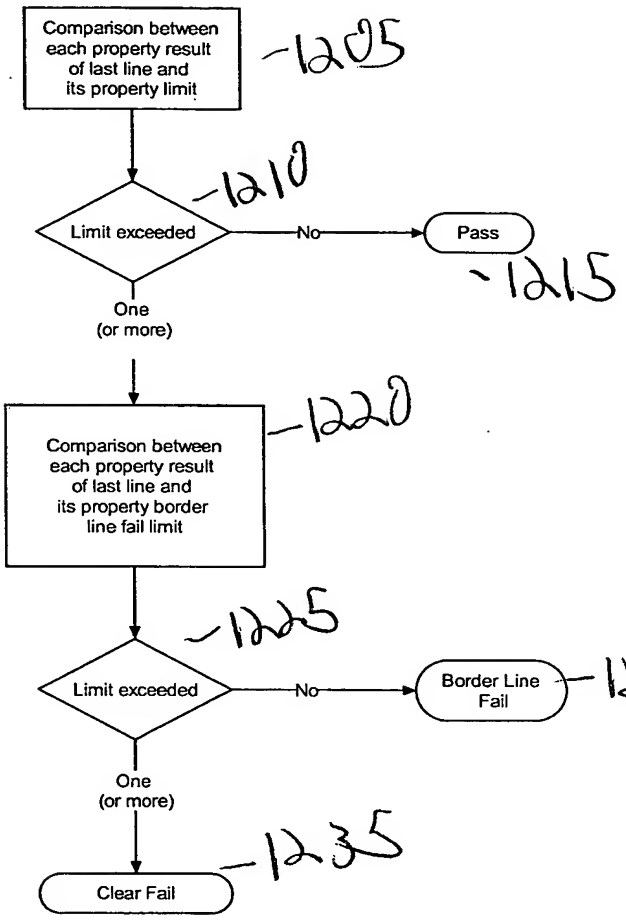


Fig. 12

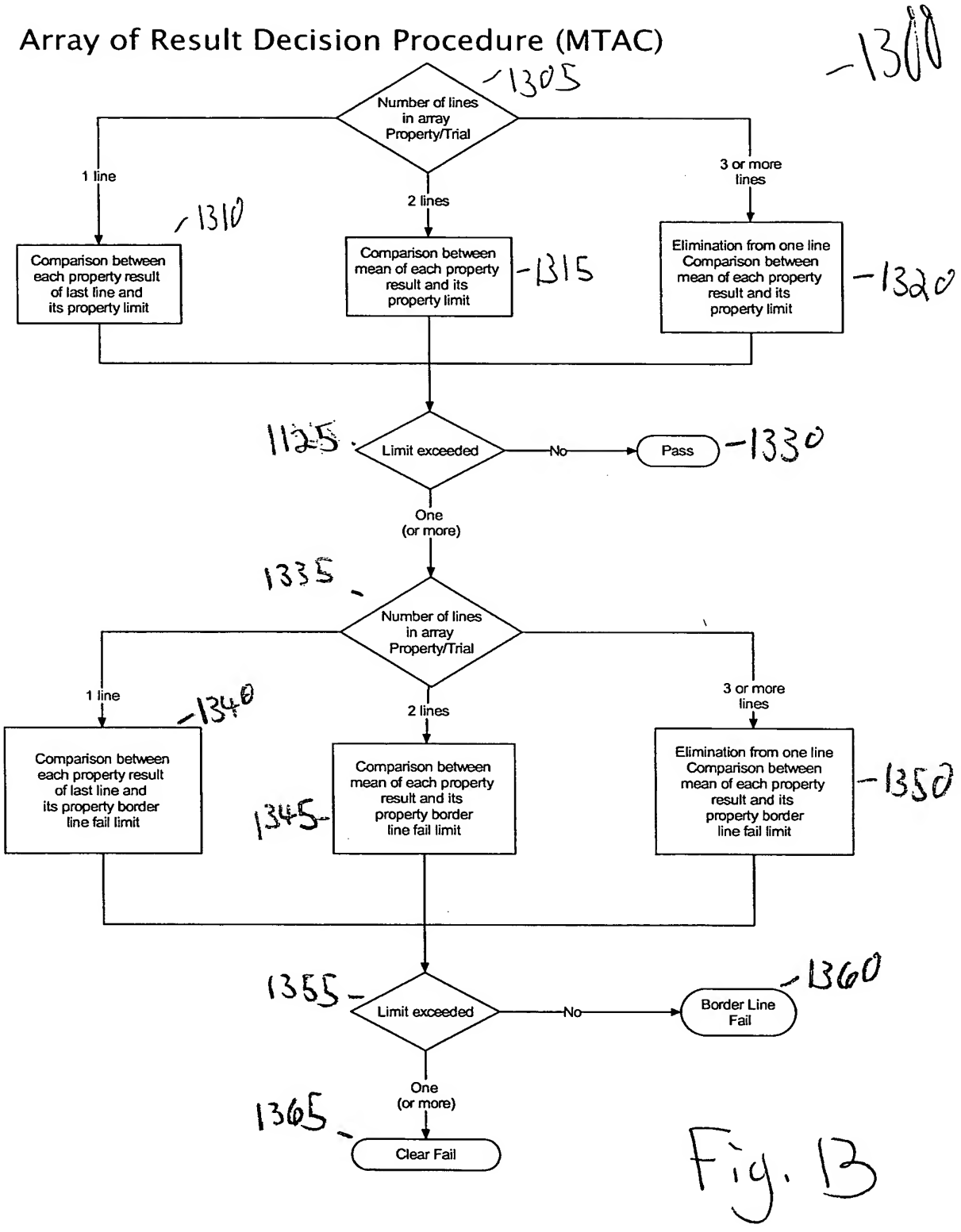

Array of Result Decision Procedure (MTAC)
1300
Number of lines in array Property/Trial
1305
1 line
2 lines
3 or more lines
Comparison between each property result of last line and its property limit
1310
Comparison between mean of each property result and its property limit
1315
Elimination from one line Comparison between mean of each property result and its property limit
1320
1325
Limit exceeded
No
Pass
1330
One (or more)
1335
Number of lines in array Property/Trial
1 line
2 lines
3 or more lines
Comparison between each property result of last line and its property border line fail limit
1340
Comparison between mean of each property result and its property border line fail limit
1345
Elimination from one line Comparison between mean of each property result and its property border line fail limit
1350
1355
Limit exceeded
No
Border Line Fail
1360
One (or more)
1365
Clear Fail

Fig. 13

Individual Test Sampling

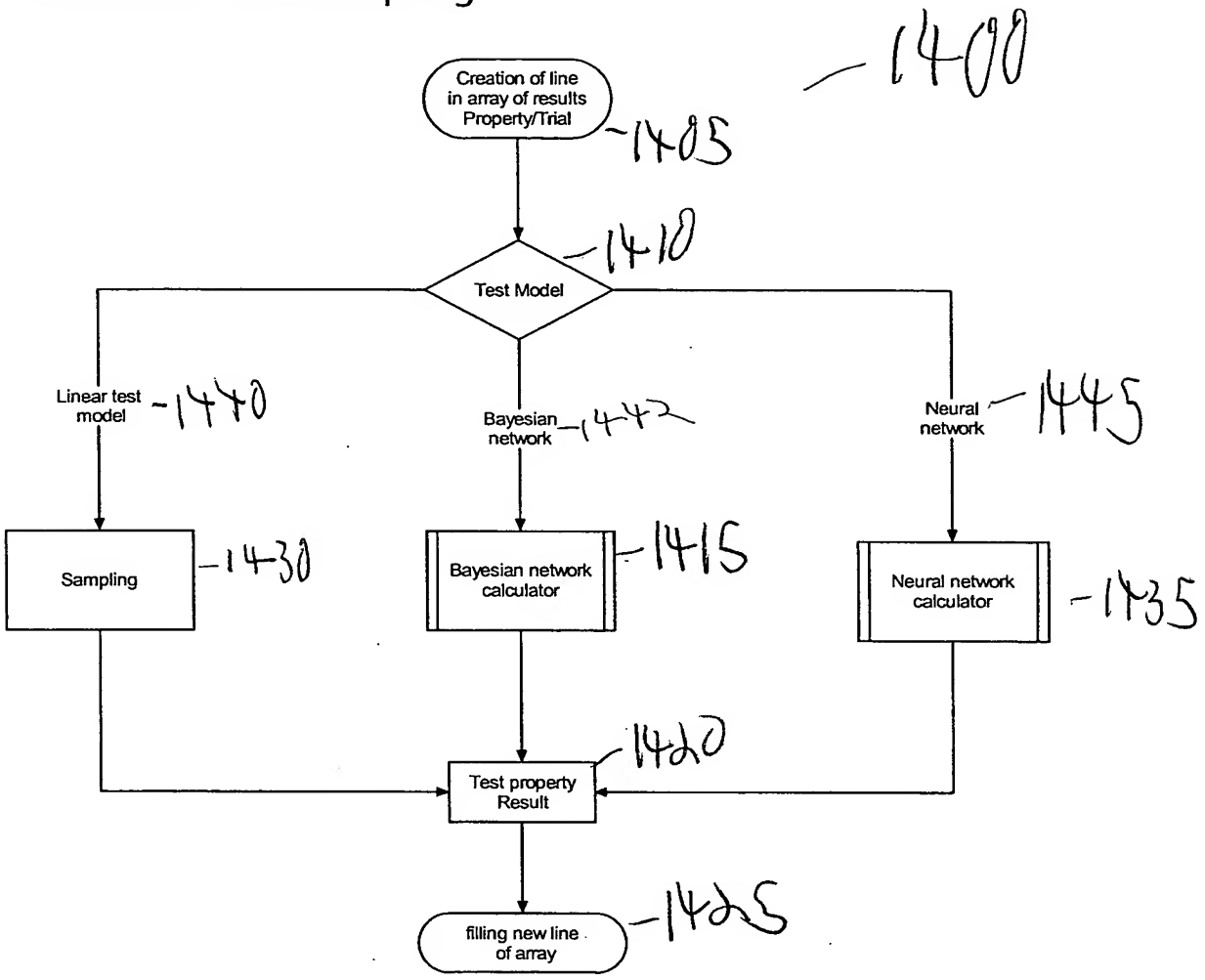


Fig. 14

Pass/Fail Decision for Parallel Tests (ExecOr)

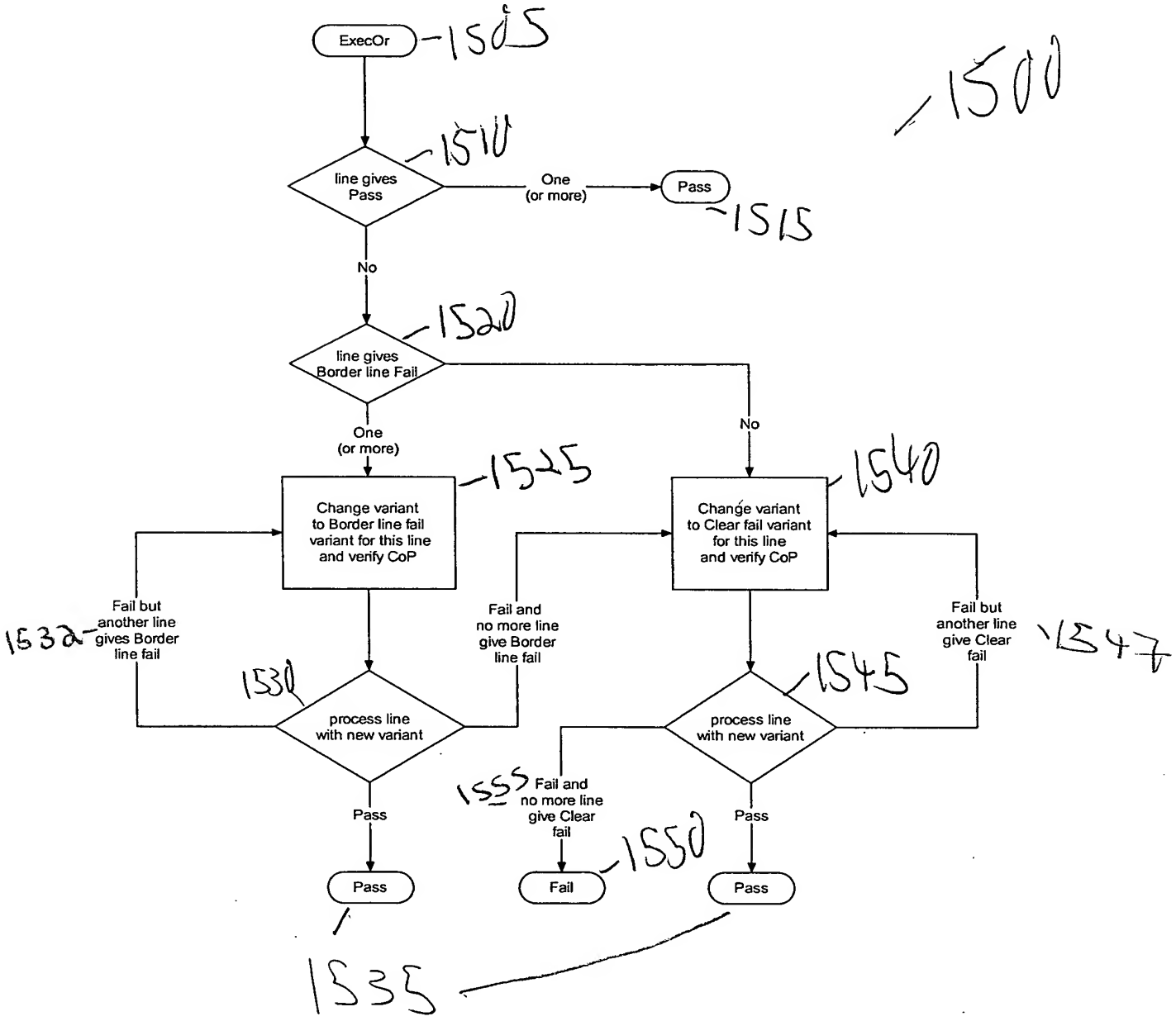


Fig. 15

Pass/Fail Decision for Parallel Tests (ExecAnd)

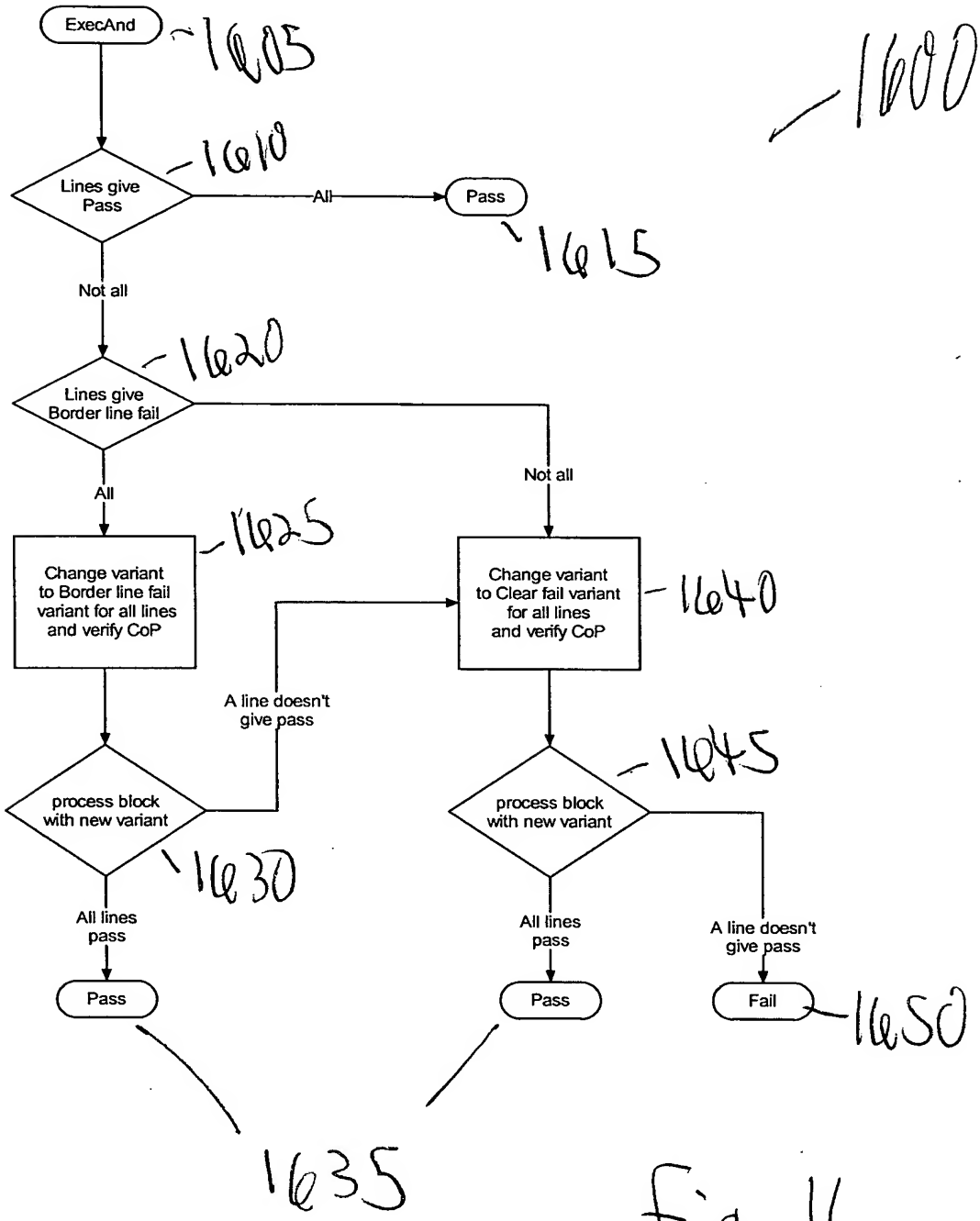


Fig. 16

Code of Practice Decision

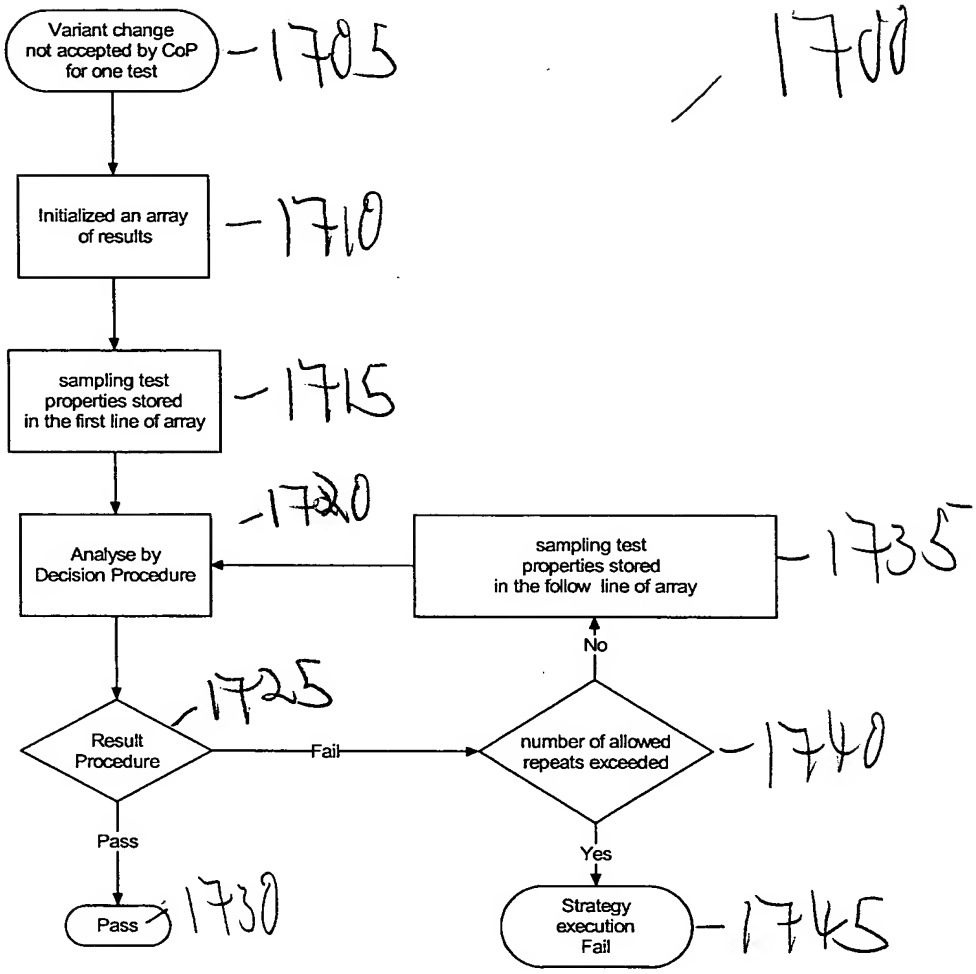


Fig. 17

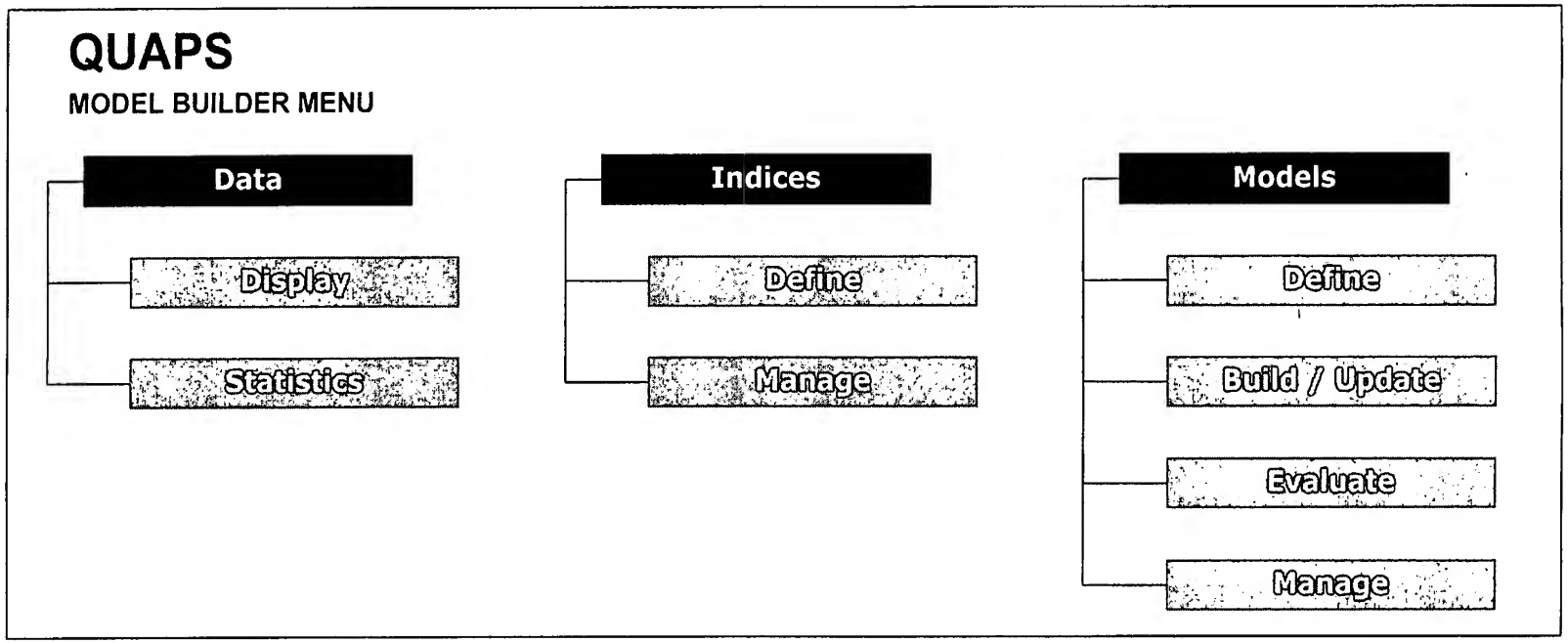

QUAPS
MODEL BUILDER MENU
Data
Display
Statistics
Indices
Define
Manage
Models
Define
Build / Update
Evaluate
Manage

Fig. 18

Page : ModDataDisplay.jsp

QUAPS

Test Data Display

Data | Indices | Models

Display

Statistics

Specification: ACEA A3-02

Test: M111

Show Data

Export (TXT)

TK	Engine Sludge	Cam Wear	V01	V02	...	V60

Fig. 19

Page : ModIndexDefine.jsp

QUAPS

Index Definition

Data | Indices | Models

Define

Manage

Index Name

◉ Discrete (High / Low)

◉ Continuous

	Variables / Indexes	Weights
☑	V1	
☑	V2	
☑	V3	
☑	Threshold	

Show variables of type: Detergent

Optimize for Spec / Test: ACEA A3-02 | M111

Optimize Weights | Optimize Threshold

Show graph(s) Property = f(Index) for

	Properties
☑	Engine Sludge
☑	Cam Wear

OK | Cancel

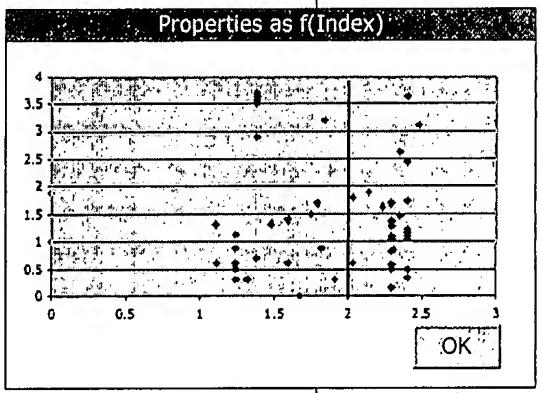


Fig 20

Page : ModIndexManage.jsp

QUAPS

Index Management

Data | Indices | Models

Define

Manage

Index Name as

- ◉ Discrete (High / Low)
- ◉ Continuous

Update Index List | Clear Index List

	Index Name
☑	I1
☑	I2
☑	I3
☑	I4

Delete Selected Indices

Fig. 21

Page : ModModelDefineStep1.jsp

QUAPS

Model Creation Wizard - Step1 - Select Specification and Test

Data | Indices | Models

Define

Build / Update

Evaluate

Manage

Specification: ACEA A3-02

Test: M111SL

Next->

Fig. 22

Page : ModModelDefineStep2.jsp

QUAPS

Model Creation Wizard - Step2 - Select Model Type

Data | Indices | **Models**

Define

Build / Update

Evaluate

Manage

Defining model for ACEA A3-02/M111SL
120 samples are available for this test

Model Name: MODM111SL_BN001

- ○ Linear Model
- ○ Neural Network
- ◉ Bayesian Network

- ◉ Find optimal indices for functional variables
- ○ Use your own indices

< Back | Next >

Fig. 23

Page : ModModelDefineStep3.jsp

QUAPS

Model Creation Wizard - Step3 - Define Functional Architecture

Data | Indices | **Models**

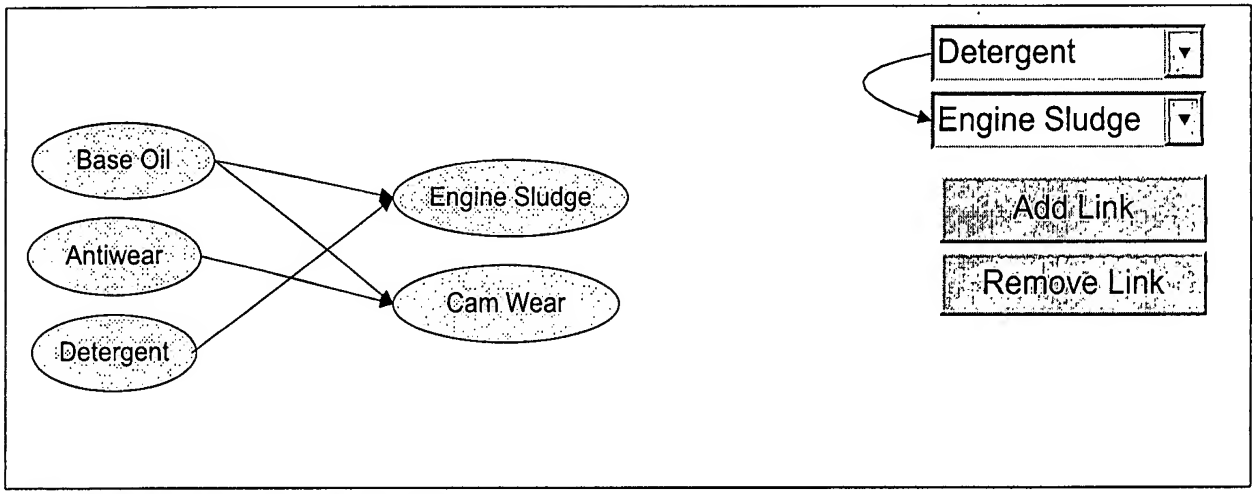
Define

Build / Update

Evaluate

Manage

Defining bayesian network model for ACEA A3-02/M111SL
Using Optimized Indices (with Discriminant Analysis)



< Back | Next >

Fig. 24

Page : ModModelDefineStep4.jsp

QUAPS

Model Creation Wizard - Step4 - View Optimized Indices

Data | Indices | **Models**

Define

Build / Update

Evaluate

Manage

Defining bayesian network model for ACEA A3-02/M111SL

Using Optimized Indices (with Discriminant Analysis)

New Index	Type	Optimized for	Formula
VLIxxxx	Base Oil	Engine Sludge AND Cam Wear	Click for detailed formula
VLIxxxx	Antiwear	Cam Wear	Click for detailed formula
VLIxxxx	Detergent	Engine Sludge	Click for detailed formula

< Back | Next >

VLIxxxt Formula

Variables / Indexes	Weights
V1	0.23
V2	0.75
V3	1.21
Threshold	0.84

OK

Fig. 25

Page : SimExecDefine.jsp

QUAPS

Execute Selected Strategies

General | Program | Finished Oils | Strategies | Execution | Monitoring

Batch

Options

Results

	Strategy	#runs	Program Execution Report (PXR) Name
☐	STR1	10000	CF4616_STR1_PXR001
☑	STR2	10000	CF4616_STR2_PXR001
☑	STR3	10000	CF4616_STR2_PXR001

STR1 ▼ Add Delete Selected

START

Fig. 26

Page : SimExecOptions.jsp

QUAPS

Strategies Execution Options

General | Program | Finished Oils | Strategies | Execution | Monitoring

Batch

Options

Results

Constraints	☑ Budget Spent	$
	☑ Time Spent	d
	☑ Max Reps / Test	

☑ Use Manual Probability when available

☑ Use Actual Test Result when available

☑ Override Program Model Selection -> ◉ Use Unconditional Model for all Tests

◉ Use Active Model for all Tests

OK | Cancel

Fig. 27

Page : SimPgmObjects.jsp

QUAPS

Define/Edit Simulation Program

General | **Program** | Finished Oils | Strategies | Execution | Monitoring

Home

Edit Program

Edit Objects

Dependent objects of Program CF4616

	Name	Type
☐	OR-F-53817F101	FO
☐	OR-F-53818FA01	FO
☐	Default Variant	Variant
☐	Var1	Variant
☐	Strategy1	Strategy
☐	Strategy2	Strategy
☐	Strategy3	Strategy

Delete Selected

Fig. 28